My Activity in the group

Takao Sakaguchi, Physics-PHENIX
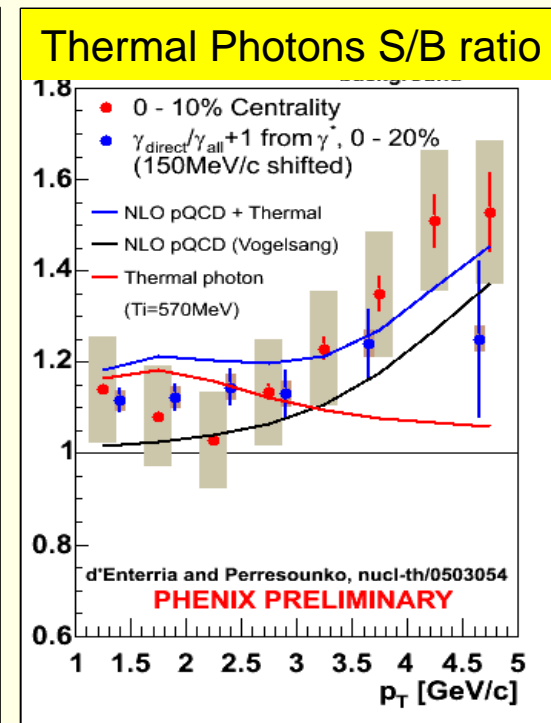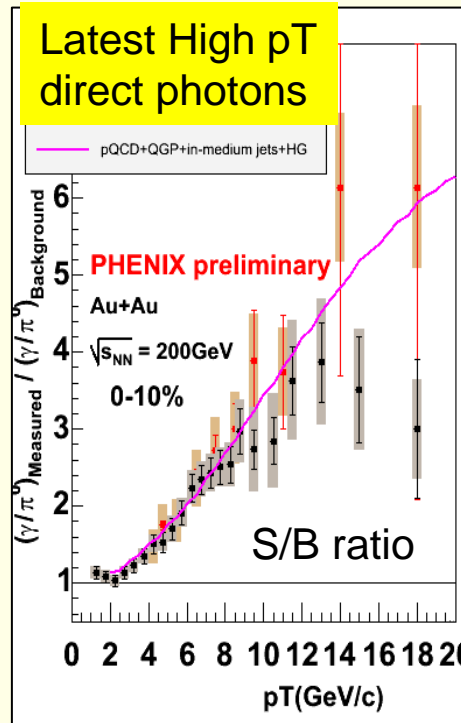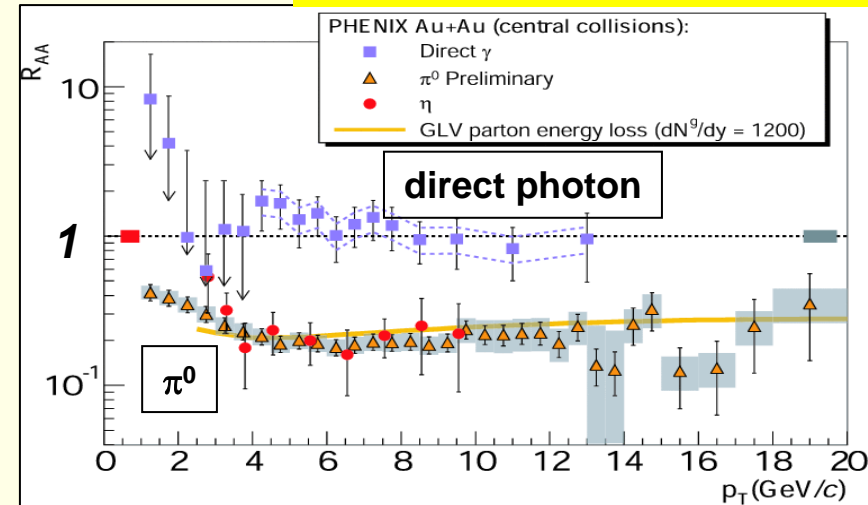
Activity Summary

- High transverse momentum (pT) π^0 measurement in Au+Au collisions
  - High pT π^0 are fragment of partons
  - Nature of the medium produced in collisions is explored through interaction of partons and medium

- High pT direct photon measurement in Au+Au collisions
  - Information on the production of partons

- Thermal photon measurement in Au+Au collisions
  - "Thermometer" of the medium produced in the collisions

- Development of Hadron Blind Detector (HBD) for thermal dileptons

- Detector operations and Advising students

Highlight of Physics results

- High pT π^0 measurement

  - *Measured highest pT that any heavy ion experiments ever reached.*
  - Yield suppressed to be ~0.2 compared to the one expected from p+p collisions
  - Consistent with models that assume *formation of very high gluon densities*. (and thus strongly-coupled "QGP")
  - *Highlight since last QM conference*

- High pT direct photon measurement

  - Yield of initial hard scattered partons are not suppressed
  - Proved that suppression of high pT π^0 is due to energy loss of the partons
  - Recently extended to *much higher pT*

- Thermal photon measurement

  - Very precise measurement
  - Consistent with models assuming initial temperature of T=570MeV
    - Temperature of "QGP"
    - *~3 times "hotter" than hadron phase*

PHENIX Au+Au (central collisions):
- Direct γ
- π^0 Preliminary
- η
- GLV parton energy loss (dN^g/dy = 1200)

direct photon

π^0

R_{AA}, p_T (GeV/c)

Latest High pT direct photons

pQCD+QGP+in-medium jets+HG

PHENIX preliminary

Au+Au

$\sqrt{s_{NN}}$ = 200GeV

0-10%

S/B ratio

$(\gamma/\pi^0)_{Measured} / (\gamma/\pi^0)_{Background}$

pT(GeV/c)

Thermal Photons S/B ratio

- 0 - 10% Centrality
- $\gamma_{direct}/\gamma_{all}$+1 from γ^*, 0 - 20% (150MeV/c shifted)
- NLO pQCD + Thermal
- NLO pQCD (Vogelsang)
- Thermal photon (Ti=570MeV)

d'Enterria and Perresounko, nucl-th/0503054

PHENIX PRELIMINARY

p_T [GeV/c]

My interest extends to Thermal dileptons
Hadron Blind Detector

- Thermal dileptons are by-product of thermal photons

- Signal to Background is very small
  - Huge electron background. Need reduction

- Tag background electron pairs via opening angle
  - Veto electrons with partner in field free region

- Hadron Blind Detector (HBD) :
  - Windowless CF_4 Cherenkov detector
  - 50 cm radiator length
  - CsI photocathode + Triple GEM with pad readout

- Construction/installation 2005/2006

Legend:
- Combinatorial background (HIJING, HBD, no rejection)
- Combinatorial background from charm (PYTHIA)
- Combinatorial background (HIJING, HBD rejection)
- Total background (HIJING+PYTHIA, HBD rejection)
- Signal without charm (EXODUS: π^0, η, η', ρ, ω, ϕ)
- Total signal (EXODUS+PYTHIA)

Reduction by ~100!

$1/N_{ev} \, dN/dm$ (100 MeV/c²)⁻¹ vs $m_{e^-e^-}$ (GeV/c²)

signal electron

Cherenkov blobs

e^-

partner positron needed for rejection

e^+

θ_{pair} opening angle

~1 m